

P1 The Earth in the Universe – Higher

Workbook answers

1	a	From the inside: core – solid, core – liquid, mantle, crust
	b	Planet, solar system, galaxy, Universe
	c	Universe, Sun, Earth
	d	Milky Way, Sun, Earth
	e	The Solar System was formed about 5000 million years ago, when a great swirl of dust and gas came together over a period of a few 100 million years. Most of that material became the Sun. Gravity pulled the remains into clumps, which joined together to become the planets.
	f	Known: B, C, D, E Unknown: A
2	a	<ul style="list-style-type: none"> • Data: new mountains, erosion; Rivers carry sediment...(whole sentence); In some places, layers of sedimentary rocks are tilted and folded. • Explanations: erosion would wear the continents flat; Sediments are compressed...(whole sentence).
	b	For example: There are six sedimentary layers, each containing typical fossils. The layers have not been folded, so the deeper the layer the older it is. A rock has fallen from the cliff; it contains a fossil showing that it came from the second layer from the top. (Scientists would be able to date the rocks by measuring their radioactivity.)
	c	<p>Two examples, e.g.:</p> <p>Magnetic data from rocks either side of oceanic ridges can show a pattern that provides evidence of seafloor spreading.</p> <p>Sedimentary rock, once at the seafloor, is found at the tops of very high mountains.</p> <p>Metamorphic rock shows recycling of sedimentary rock, heated deep inside the Earth's crust.</p> <p>Folding of sedimentary layers indicates that the Earth's surface has been 'wrinkled', by enormous forces.</p> <p>Some craters have been eroded so much that they are invisible from the Earth's surface.</p>
3	a	From left to right: South, Africa, India
	b	Missing words: The Origins of Continents and Oceans, peer review
	c	1, 2, 4, 6, 5, 3
	d	Missing words: data, explanation, measure, simpler, geologist, big
	e	Ticks for: accounts for all observations; links things that were previously thought unrelated; leads to predictions that are later confirmed

4	a	Convection currents in the solid mantle push oceanic plate outwards from an oceanic ridge, uniformly on each side, at a rate of about 10 cm a year. Some of the mantle melts to form magma, where it erupts through the seafloor. The magma cools here and becomes new rock, forming a ridge.
	b	<p>i Like zebra stripes, symmetrical on either side of the ridge.</p> <p>ii As hot magma rises in the gap between plates, it spills out to both sides and solidifies, recording the Earth's magnetic field at that time.</p>
5	a	Missing words: tectonic plates, convection currents, mantle, radioactive decay
	b	<p>M – mountain chains – best examples are along the western edges of North and South America; also where the Africa plate meets the Indo-Australian plate (e.g. Himalayas)</p> <p>R – oceanic ridges – where plates are moving apart in the oceans; best example is the mid-Atlantic ridge</p> <p>C – oceanic crust – a good example is the Pacific plate</p> <p>E – earthquakes – where plates are moving against each other, e.g. western edge of the Americas, western edge of Asia, where Africa and Eurasian plates meet</p> <p>V – volcanoes – where plates are moving towards each other, e.g. Mt St Helens (west coast of North America), Vesuvius/Etna (Italian coast), Krakatoa (Indonesia)</p>
	c	Missing words: solid, flow, atoms, radioactive, decay, hot, spreading, oceanic
	d	M M E
	e	Clockwise from top: lava flows, sediment, oceanic plate, rock carried into subduction zone
	f	<ul style="list-style-type: none"> • Earthquakes: Plates push and rub against each other. Forces build up along these fault lines. When chunks of rock along the edge of a fault break, the plates move suddenly, causing the ground to shake. • Volcanoes: Heating of an oceanic plate, as it moves under continental plate at a destructive margin, melts rock and causes vents to appear, through which lava escapes. • Mountain building: Plates push against each other, forcing the crust to buckle and fold. • Parts of the rock cycle: One plate moving under another takes with it sedimentary rock, which melts (igneous rock) and changes (metamorphic rock). Folding and faulting causes the rock to rise to the Earth's surface, where it is worn and washed away again (sedimentary rock).
6	a	Clockwise from top left: volcano; coastal areas destroyed; land, roads, and buildings buried; earthquake
	b	To minimize harm to people by being able to give early warning of imminent danger.
	c	<p>1 Educate people, so they will know what to do</p> <p>2 Organize public drills, so everyone can practise what to do.</p> <p>3 Enforce building regulations, which can reduce the chance of buildings collapsing</p>

		4 Prepare emergency plans, so trained staff can then respond quickly				
7	a	Correctly labelled diagram				
	b	<ul style="list-style-type: none"> • A comet is a rocky lump, held together by frozen gases and water, that orbits the Sun. • An asteroid is dwarf rocky planet, generally orbiting the Sun between the orbits of Mars and Jupiter. • A moon is a natural rocky satellite that orbits a planet. • Typically, a moon is larger than an asteroid, which is larger than a comet. 				
	c	Radioactive dating of rock samples from Earth, the Moon, Mars, and meteorites show that none is older than 5000 million years.				
	d	Missing words: Arizona, volcano, iron, meteor, support, pressures, reverse order, violent impact				
8	a	A mass extinction is when many species of plant and animal die out at the same time.				
	b	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>A E</td> <td>F</td> </tr> <tr> <td>B C</td> <td>D</td> </tr> </table>	A E	F	B C	D
A E	F					
B C	D					
	c	<ul style="list-style-type: none"> • An asteroid strike: the ground and asteroid were partly vaporized, making huge amounts of dust and poisonous gases that were carried round the world by winds, blocking out sunlight. This cooled the Earth's surface and prevented photosynthesis, killing plants and so starving to death animals which depended on them. • Massive eruptions of lava: making huge amounts of dust and poisonous gases that were carried round the world by winds, blocking out sunlight. This cooled the Earth's surface and prevented photosynthesis, killing plants and so starving to death animals starved which depended on them. 				
	d	You cannot wind the clock backwards and watch what happened. The best that can be done is to use available evidence to create a likely explanation.				
9	a	...their light reaches Earth				
	b	A C B E D				
10	a	<p>Missing number: 300 000</p> <ul style="list-style-type: none"> • Sun: 8 light minutes • Proxima Centauri: 4.2 light years • Arcturus: 36.7 light years 				
	b	The more distant an object is, the older it is. Because light travels at a finite speed, looking out into space is looking back in time.				
	c	A light year is the distance travelled by light in one year.				
	d	<ol style="list-style-type: none"> 1 measuring the amount of parallax 2 comparing the brightness of (similar) stars 				

	e	<ul style="list-style-type: none"> • Parallax method: It is very difficult to measure very small angles. • Brightness method: it is difficult to be sure that distant stars are identical in the amount of light they give out.
	f	Example: There are millions and millions of planets in the Universe. Many stars have planets. Chances are that some stars have planets with the right conditions for life (temperature, water, etc.), where some form of life has evolved.
	g	Example: Life occurs because of a very complex combination of circumstances and developments – the chances of these being repeated are remote. SETI has so far (since 1992) detected no sign of <i>intelligent</i> life elsewhere.
11	a	Streetlights and car parks...direct light upwards into the night sky. Upward-travelling light scatters off particles in the atmosphere to...make the night sky glow brightly. Faint, deep sky objects such as galaxies and nebula...become impossible to see.
	b	Outside the Milky Way / within the Milky Way
	c	Hubble's telescope enabled him to make a better measurement of the distance to Andromeda.
	d	From the top: galaxies, Milky Way, light years, Sun, stars
12	a	<ul style="list-style-type: none"> • Missing words: red, faster, expanding • Caption, e.g.: Imagine yourself on the surface of a very big balloon looking along a line of galaxies at 1-metre intervals. If the balloon is expanding, every metre is growing larger. If the distance between you and the first galaxy moves by half a metre, then the distance between you and the second galaxy will appear to move by a metre, and the third galaxy will appear to move away by one and a half metres. The further away a galaxy, the faster it will appear to move. • Missing words: explanation, 13 7000 million, big bang
	b	Any 3 of following: Expansion of the Universe Discovery of cosmic microwave backed radiation, an afterglow of the big bang Explains why the early Universe was about 24% helium by mass Oldest stars are younger than the calculated age of the Universe
	c	Peer review is when experts review a scientific paper before it is published, to make sure that what is published is correct, and has something new and useful to say.
	d	Through peer review, scientists describe their ideas in detail. Any data/observations will be severely challenged and may be tested. Those that survive this process are more likely to be reliable.
	e	Scientists can't agree on the evidence (whether the rate of expansion of the Universe is increasing) or how to explain it. Also, they can cannot estimate its mass accurately and so cannot estimate the gravitational force slowing its expansion.
	f	Hawking suffers from motor neuron disease. He has been in a wheelchair most of his adult life, dependent on others for his basic physical needs. What does work is his

	remarkable mind: he has been able study the Universe and theorise about it, and is one of the world's leading cosmologists.
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P2 Radiation and life – Higher

Workbook answers

1	a	i	Visible light – is detected by eyes – allows people to see Infrared – makes you feel warm ultraviolet – damages cells and can cause skin cancer
		ii	From the top: ultraviolet, visible light, infrared
		iii	Glass – transmit, paper – reflect, body – absorb
	b	<ul style="list-style-type: none"> • Benefits – makes me feel good, makes vitamin D • Risks – can start skin cancer, can damage retina 	
c	i	<ul style="list-style-type: none"> • Outcomes – do better in exams, have a car accident • Possible factors – polite, drinking alcohol 	
	ii	Correct bold words: correlation, cause, A	
d	i	Missing words: sun protection factor Correct bold words: ultraviolet, high, increase, decrease	
	ii	For example: cover up with clothing, stay in the shade during early afternoon	
2	a	i	Missing words: atmosphere, transmits plants, absorbs ozone layer, absorbs
		ii	The atmosphere is a mixture of gases that surrounds the Earth; it transmits sunlight – This allows life to continue. A plant produces starch when it absorbs sunlight – This is photosynthesis. The ozone layer is part of the atmosphere which absorbs ultraviolet radiation – This protects living organisms.
	b	Where ozone is found – in the atmosphere, a thin layer, 20 km up What ozone protects us from – ultraviolet radiation What ozone is – O ₃ molecules, made from 3 oxygen molecules What CFCs do – banned chemicals that harm the ozone layer /destroy ozone molecules UN action – Montreal Protocol 1987 Oxygen to ozone – free atoms of oxygen combine with oxygen molecules to make ozone Ozone to oxygen – ultraviolet radiation breaks ozone molecules into oxygen molecules and oxygen atoms (also breaks oxygen molecules into oxygen atoms)	
3	a	i	<ul style="list-style-type: none"> • infrared • human bodies • camera

		ii	<ul style="list-style-type: none"> e.g. steel e.g. air
	b		Correct bold words: Sun, emits, atmosphere, absorbed, skin
	c		4, 2, 3, 1, 5
4	a		Correct bold words: heat up, more, high, ionization, molecules, ions, chemical
	b		List A: electromagnetic List B: spectrum
	c		Photon
	d	i	From least energy to most energy: radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, gamma rays
		ii	Ionizing radiation: gamma, X-raysultraviolet
		iii	H next to all the boxes except radio waves
5	a		Metal – reflect – protective casing
	b	i	100 watts
		ii	Less
		iii	6 minutes
	c	i	Risks: e.g. electric shock, can burn yourself, can burn toast Benefits: e.g. toasts bread, easy to use, convenient
		ii	Benefits outweigh risks
		iii	It makes you think carefully about factors and their relative importance/weightings.
		iv	It became smaller
6	a	i	Microwaves
		ii	Reduces the intensity of radiation reaching the brain
		iii	To reduce the risk of brain tumour
		iv	Correct bold words: safe, sorry
	b		For example: Things happen, e.g. you could walk in front of a moving car because using your phone distracted you.
	c		A – top left and right P – bottom left and right
7	a	i	1, 3
		ii	1, 3
		iii	With a small sample of people, the results that Frances obtains might simply be a result of chance. Georgia shows this by flipping coins, getting the same results as Frances. In both cases, the chances of getting a correct answer each time are 50:50.

	b	i	B, C, F, G						
		ii	Yes						
		iii	Her results seem to confirm the link, but are probably only due to chance – a sample of four is not big enough to test Frances's claim.						
		iv	For example: eye colour, time of day						
		v	Dark hair enables a person to emit 'tele-waves'.						
	c	i	None, none						
		ii	Correct bold words: more, decreased						
8	a		When energy carried by microwaves is absorbed... it causes a heating effect. Radiation is called 'ionizing' if... it causes ionization. If ionizing radiation damages a cell's DNA... it may start a cancer tumour. When large amounts of ionising radiation strike living cells... it kills the cells.						
	b		<table border="1"> <tr> <td>e.g. good shoe fit</td> <td>e.g. gives doctor information that will be used to plan treatment</td> </tr> <tr> <td>no</td> <td>yes</td> </tr> <tr> <td>e.g. no, checking shoe fit can be done equally well without using X-rays</td> <td>e.g. yes, risk is small compared to the benefits</td> </tr> </table>	e.g. good shoe fit	e.g. gives doctor information that will be used to plan treatment	no	yes	e.g. no, checking shoe fit can be done equally well without using X-rays	e.g. yes, risk is small compared to the benefits
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e.g. no, checking shoe fit can be done equally well without using X-rays	e.g. yes, risk is small compared to the benefits								
	c	i	As Low As Reasonably Achievable						
		ii	For example: handling radioactive wastes, medical procedures, road safety measures						
9	a		The Sun – a white hot star – emits a mixture of high-energy electromagnetic radiation (up to ultraviolet) The Earth – a warm planet – transmits visible light but absorbs low-energy infrared and some ultraviolet The Earth's atmosphere – a mixture of gases that surrounds the Earth – emits low-energy electromagnetic radiation (mainly low-energy infrared)						
	b		Sun's radiation: the whole box shaded Earth radiates: the right-hand third of the box (infrared end) is shaded						
	c		The energy radiated by the Earth into space = the energy of the Sun's radiation absorbed by the Earth						
	d	i	Methane, carbon dioxide, water vapour						
		ii	Correct bold words: increasing, increase, raise, change						
	e		Columns from left to right: <ul style="list-style-type: none"> • 15°C, liquid, life can exist • -18°C, solid, life cannot exist • 17°C, the climate will change 						

10	a	<ul style="list-style-type: none"> • Labels in boxes: atmosphere and oceans, fossil fuels, plants, animals • Labels by arrows: (top right) respiration, (middle left) photosynthesis, (middle right) eating, (bottom) decomposing • blue ring: photosynthesis • green ring: respiration (x2), decomposing • red ring: burning fuels
	b	Correct bold words: decomposers, releasing, carbohydrates
	c	<ul style="list-style-type: none"> • Missing words: (left) photosynthesis; (right) respiration, decomposing (error in workbook – should be two missing words in the right-hand box) • Correct bold word: equalled
	d	<ul style="list-style-type: none"> • Burning fuels has hugely increased • Forests have been destroyed
	e	<ul style="list-style-type: none"> • is less than • increases it
	f	Missing words: energy, photosynthesis. Correct bold words: small, uses up
	g	Missing words: carbon dioxide, water, energy, oxygen, glucose
11	a	Weather, climate, climate, weather
	b	Rings round all items in the list Underlined: data from ice cores, growth rings in trees
	c	Rising sea levels – low-lying cities flooded and farmland covered Extreme weather including heavy rains and flooding – damage to property and rising insurance premiums Disruption to the warm air and ocean currents from the tropics – temperatures drop in UK and northern Europe Average temperature rises – mosquitoes carrying malaria move to currently temperate areas
12	a	Scientists agree about this: – The Earth is warming up... – Human activities contribute... – To stabilize climates... – Weather conditions... Scientists do not all agree about this: – Future emissions... – The UK will have... – Global warming... – If carbon dioxide concentrations...

	b	<ul style="list-style-type: none"> • e.g. travel less by air, use less energy at home, use cars less • e.g. increase taxation on fuels, pass laws about energy efficiency of buildings and appliances, invest in alternative was of producing energy
	c	<ul style="list-style-type: none"> • This makes it more difficult for scientists to agree on the causes because it takes longer to test the theories. • It is more difficult to test the effectiveness of remedies because scientists have to wait a long time to measure the effects.

P3 Radioactive materials – Higher

Workbook answers

1	a	i	Heating water using a gas boiler
		ii	Gas boiler 20%, electric immersion heater 52%
		iii	At the power station
	b	i	Electricity
ii		Electricity is made from another (primary) energy source	
c	It is convenient – comes on at the flick of a switch. It can easily be transmitted over long distances. It can be used by a wide variety of devices.		
	Correct bold words: increasing, generate, winter's, blackouts, fossil, carbon dioxide, 'greenhouse', climate		
	2	a	<ul style="list-style-type: none"> • Natural sources: radon in air, from rocks, cosmic rays from where she lives, cosmic rays from air travel, from food and drink • Artificial sources: from medical treatments, from nuclear industry and fallout
		b	Natural sources 1.28 mSv, artificial sources 0.057 mSv
c	A small increase		
d	Less than the national average		
e	Much less than 3%		
	f	For example:	
		<ul style="list-style-type: none"> • miners – from rocks and buildings • air crew and frequent fliers – cosmic rays from air travel • medical staff using radioactive materials – from medical treatments • some workers in nuclear industry – from nuclear industry and fallout 	
3	a	Correct bold words: alpha, most, bigger, short, easily, small, contamination	
	b	The radon builds up in an enclosed area. People → breathe in atoms of the gas, which might → give off alpha radiation inside a person's lungs. The alpha particles → are absorbed by soft, internal tissue. They can → ionize atoms in cells; this can → damage the cells or cause a cancer.	
	c	<ul style="list-style-type: none"> • Irradiation: dose from radioactive materials in cloud, rain washing radioactive materials out of the air, dose from radioactive materials deposited on the ground • Contamination: dose from radioactive materials in the air, dose from eating and drinking radioactive materials in food, dose from breathing in sea spray and sand 	

4	a																				
		Type of radiation	Is absorbed by a thin sheet of paper	Is absorbed by a thin sheet of aluminium	Is absorbed by a thick sheet of lead																
		alpha	✓	✓	✓																
		beta	✗	✓	✓																
		gamma	✗	✗	✓																
	b	<ul style="list-style-type: none"> • X-ray → Passes through soft tissue and is absorbed by dense tissue. It can be controlled and directed by the machine that makes it. → Taking photographs of internal structures like bones • Beta radiation → Is absorbed by cells and can kill them. → Treating cancers by killing the cancerous cells • Gamma radiation → Penetrates tissue easily and is given out by the nuclei of atoms which can be injected into the body. → Providing images of organs to look for abnormal function 																			
	c	Correct bold words: medical, cells, cancer, small, benefits																			
	d	i	1800 euros																		
		ii	Uzbekistan cannot afford to use this technology.																		
5	a	<ul style="list-style-type: none"> • Wear gloves and an apron – to prevent clothes and skin being contaminated with sources of ionizing radiation • Wear protective clothing and stand behind a screen – to block out the radiation and reduce the dose and risk due to irradiation • Wear a special badge that is sensitive to ionizing radiation – to monitor the radiation dose over a year 																			
	b	i	<table border="1"> <thead> <tr> <th></th> <th>alpha</th> <th>beta</th> <th>gamma</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>B</td> <td></td> <td>✓</td> <td>✓</td> </tr> <tr> <td>C</td> <td></td> <td></td> <td>✓</td> </tr> </tbody> </table>				alpha	beta	gamma	A	✓	✓	✓	B		✓	✓	C			✓
	alpha	beta	gamma																		
A	✓	✓	✓																		
B		✓	✓																		
C			✓																		
		ii	Hospital radiologist, scientist in a nuclear power station, technician who sterilizes surgical equipment with gamma rays																		
	c	i	<p>Radiologist – This is an example of trying to keep risk as low as possible.</p> <p>Policewoman – This is an example of the idea that nothing can ever be completely safe.</p> <p>Doctor – This is an example of balancing the benefits against the risks.</p> <p>Patient – This is because the risk depends on the total radiation dose you have received.</p> <p>Airline pilot – This is an example of a new technology presenting a new risk.</p>																		
		ii	This is an example of the requirement to keep the risk as low as reasonably achievable.																		

		iii	<ul style="list-style-type: none"> • Radiation worker • Construction worker
		iv	Correct bold words: higher, consequence, worse, consequence
6	a	i	<ul style="list-style-type: none"> • Coal – contains some C-12 atoms; black and crumbly; contains some C-11 atoms; is slightly radioactive • Diamond – very hard, transparent, and sparkly; contains some C-12 atoms; contains some C-11 atoms; is slightly radioactive • Cellulose – contains some C-12 atoms; contains some C-11 atoms; part of the structure of plant cells; is slightly radioactive • Carbon dioxide – contains some C-12 atoms; colourless gas; contains some C-11 atoms; is slightly radioactive
		ii	Contains some C-12 atoms; contains some C-11 atoms; is slightly radioactive
		iii	Correct bold words: different, chemical, element, is not, nucleus, nucleus
	b	i	Outer layer labelled: electrons, negative charge Inner circle labelled: nucleus, contains neutrons, contains protons, positive charge
		ii	500 m
	c		<ul style="list-style-type: none"> • Neutrons: They are neutral – they have no charge. The number in the nucleus can vary for atoms of the same element. If there are too many or too few of these in the nucleus, then it may be unstable. • Protons: The number in the nucleus is always the same for atoms of a given element. They have a positive charge. The number in the nucleus equals the atomic number of the element.
	d	i	Ticks by the first and last atoms (both have 86 protons).
		ii	Atom Z would have 2 more protons. (The new atom has 84 protons, not 86.)
		iii	Arrow drawn from nucleus to alpha particle.
7	a		Correct bold words: pulp, more, machine, reduce
	b		It does not alter the food in terms of taste, texture, etc.
	c		Normally there is no smoke in the detector. The alpha radiation → ionizes air in a small chamber. The ions → carry a current in the chamber and the alarm is kept off. → If some smoke gets in the chamber, it → stops some of the alpha radiation so the detector's signal → changes and that sets off the alarm.
8	a		Missing words: boiler, turbine, generator, transformer

	b	<ul style="list-style-type: none"> • Nuclear fuel – is made into fuel rods which get extremely hot • Fossil fuel (coal, gas, or oil) – is burnt at very high temperatures in a furnace • Generator – produces a voltage when its shaft is spun round • Transformer – changes a low voltage into a higher voltage • Turbines – are driven round by the high-pressure steam • Boiler – turns water into high-pressure steam <p>(Note: error of sample line will be corrected at reprint.)</p>												
	c	<p>The table should be left with the following:</p> <table border="1"> <thead> <tr> <th></th> <th>Fossil fuel power stations</th> <th>Nuclear power stations</th> </tr> </thead> <tbody> <tr> <td>The power stations produce...</td> <td>carbon dioxide waste</td> <td>radioactive waste</td> </tr> <tr> <td>This waste...</td> <td>contributes to global warming</td> <td>is hazardous for thousands of years</td> </tr> <tr> <td>People living near the power stations are...</td> <td>sometimes exposed to other pollutants</td> <td>at risk of catastrophic accidents</td> </tr> </tbody> </table>		Fossil fuel power stations	Nuclear power stations	The power stations produce...	carbon dioxide waste	radioactive waste	This waste...	contributes to global warming	is hazardous for thousands of years	People living near the power stations are...	sometimes exposed to other pollutants	at risk of catastrophic accidents
	Fossil fuel power stations	Nuclear power stations												
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This waste...	contributes to global warming	is hazardous for thousands of years												
People living near the power stations are...	sometimes exposed to other pollutants	at risk of catastrophic accidents												
	d	<p>Correct bold words: nuclear, neutron, unstable, fission, releases</p> <p>(Note: part d not c)</p>												
	e	<p>A single neutron → is absorbed by a nucleus of uranium-235. This → makes the nucleus unstable. The nucleus → splits into two smaller nuclei. This fission reaction → releases energy and sends out → three more neutrons. Each of these → is absorbed by a nucleus of uranium-235. This → makes the nucleus unstable...</p> <p>(Note: part e not d)</p>												
	f	<p>Correctly coloured diagram and text. (The control rods are in the nuclear reactor. The coolant circulates between the reactor and the boiler. The water enters the coil in the boiler at the bottom, and exits as steam at the top.)</p> <p>(Note: part f not e)</p>												
	g	<p>Missing words:</p> <ul style="list-style-type: none"> • fission, chemical • chemical, fission • fission, chemical <p>(Note: part g not f)</p>												
9	a	<p>Correct bold words: radioactive, decreases, by a half, can, longer</p>												
	b	<p>A: 0, 8, 16, 24 B: 0, 15.7, 31.4, 47.1</p>												
	c	<p>i 8 days – 32g, 16 days – 16g, 24 days – 8g</p>												
		<p>ii 5 half-lives, 40 days</p>												
		<p>iii The half-life; the background count</p>												

10	a	<ul style="list-style-type: none"> • LLW – Made up of used protective clothing...– It is very bulky... • ILW – Made up of materials from inside the reactor...– It is chopped up and mixed... • HLW – Made up of the most dangerous fission products...– It is not very bulky but... 																																														
	b	Missing words: hazardous, absorbed, irradiation, contamination, food, safe, precautionary																																														
11	a	Life Cycle Assessment																																														
	b	£440 million + £700 million = £1140 million																																														
	c	Cradle (building) → use (running) → grave (decommissioning)																																														
	d	Cost: £3000 million, £1140 million, £3900 million																																														
	e	Decommissioning																																														
	f	£3000 million + £1140 million + £3900 million = £8040 million																																														
	g	Full costs include building, running and decommissioning.																																														
12	a	i	Wind farm																																													
		ii	Building and decommissioning costs are smaller.																																													
		iii	Wind is intermittent (does not always blow).																																													
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